PATENT SPECIFICATION

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DRAWINGS ATTACHED

1 210 191

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(54) IMPROVEMENTS IN OR RELATING TO TRUNNION SEALS

(71) We, DANA CORPORATION, a corporation organized under the laws of the Commonwealth of Virginia, United States of America, of 4100 Bennett Road, City of Toledo, State of Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it it to be performed, to be particularly described in and by the following statement:—

This invention relates to trunnion seals in general and, more particularly though not exclusively, to a multi-lip, labyrinth type seal for use with a Cardan-type universal joint for sealing the opening between the trunnion of the journal cross and the open end of the trunnion bearing race rotatably mounting the journal cross.

Seals that close the opening between the trunnion and the open end of the bearing race are well known in the art and are provided to insure that the lubricant within the bearing race does not escape therefrom and that external contaminants may not enter the bearing race to inhibit the proper lubrication thereof.

Prior art means for sealing the opening between the open end of the bearing race and the trunnion have taken many forms of resilient single- or multi-lip seals with metal backings. These devices, however, did not provide means to protect the resilient material from the action of external contaminants by a labyrinth type arrangement, but used metallic elements solely to provide a preloaded element to maintain sealing contact by the resilient material after it becomes worn or deteriorated.

It is desirable, therefore, to provide a seal including a resilient material for sealing the opening between the open end of the bearing race and the trunnion, which seal will retain lubricant within the bearing race and prevent the ingress of contaminants therein.

Multi-lip seals embodying the present invention can be constructed which prevent contaminants from reaching the resilient sealing material and provide a tighter sealing relationship with the trunnion under conditions of increasing speeds; further such multi-lip seals can be so constructed that it is not necessary to dismantle them in order to relubricate the needle bearings.

According to the present invention there is provided a seal for sealing the space between a bearing race member and a trunnion, comprising a first annular metallic member encircling the trunnion, an annular elastomeric member which encircles the trunnion between the trunnion surface and the first annular metallic member and is bonded to the first annular metallic member, and a second annular metallic member, of generally U-shaped radial cross-section, encircling the trunnion spacedly from the first annular metallic member, the second annular metallic member partially encompassing the annular elastomeric member and the first annular metallic member to form a labyrinth seal therebetween.

In order that the invention may be better understood and more readily carried into effect, the same will now be described, by way of example, with reference to the accompanying drawing, in which:—

Figure 1 is a fragmentary plan view, partially in section, showing sealing means embodying the present invention in conjunction with a journal cross with bearing races mounted thereon; and

Figure 2 is a view of part of the arrangement shown in Figure 1.

In the terminology used within the specification and claims appended thereto, the term axial shall be used in reference to the axis of the trunnion of the arm of the journal cross member, and the term radial shall be construed as extending perpendicularly relative to the axis of the journal cross arm.

Referring to Fig. 1, a journal cross 10 of a Cardan-type universal joint 11 is shown. This journal cross includes a central body portion 12 having four trunnions 14 extending therefrom in a circumferentially

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equally spaced relationship. The trunnions 14 are generally cylindrical in shape and formed integral with the body portion 12 so as to form a unitized assembly therewith. Disposed over the axially outer end of the trunnion 14 is a cup-shaped bearing race 16. Each of these bearing races is adapted to be secured in a suitable manner to a yoke arm 17 (shown only fragmentarily) of a universal joint yoke member. Because the assembly of each of the bearing races 16 and the trunnions 14 is similar, the remainder of this description will refer to only a single bearing race and trunnion.

An axially outer face 20 of the trunnion 14 and an axially inner surface 22 of a cap or closed end 24 of the bearing race 16 rotationally engage each other in a thrusting relationship to limit movement of the trunnion 14 relative to the bearing race 16. An outer cylindrical periphery 26 forming the surface of the cylindrical trunnion 14 and an inner cylindrical surface 28 formed by the bearing race 16 are spaced from each other to provide for reception within this space of an annulus of needle bearings 30 adapted to rollingly engage the cylindrical surface 28 of the bearing race and the periphery 26 of the trunnion to thereby provide substantially frictionless rotation therebetween.

Referring to Fig. 2, a sealing means shown generally at 40 is provided to seal the opening which exists between the open end of the bearing race 16 and the trunnion 14. The sealing means 40 includes a first annular metallic member 42 formed with two inclined annular rim portions so as to be of generally inverted L-shaped cross-section as seen in Fig. 2, an annular resilient elastomeric member 44 which is bonded together with the first annular metallic member 42 to form a unitized structure, and a second annular metallic member 46 of generally U-shaped cross section which receives within its bight a portion of the elastomeric member 44.

The radially inward end of the trunnion 14 is provided with three sealing surfaces. The first sealing surface 50 is located towards the axially outer end of the trunnion and engages in a sealing relationship with a first annular sealing lip 52 formed on the inner periphery of the resilient elastomeric member 44. The second sealing surface 54 is located axially inward from and adjacent to surface 50, is slightly larger in diameter than surface 50, and engages a laterally and radially innermost surface 55 of the annular metallic member 46 of U-shaped cross-section in a press fit relationship so that the annular metallic member 46 rotates in unison with the trunnion 14. Adjacent the second sealing surface 54 on the trunnion 14 is a third sealing surface 56 cut on an acute angle relative to the axis of the trunnion 14, upon which the innermost surface of the annular metallic member 46 is seated. The surface 56 also provides for a smooth transition between the central body portion 12 and the trunnion and also provides an abutment area which is necessary to assure proper spacing axially inwardly for the annular metallic member 46 of the sealing means 40 relative to the axial outer face 20 of the trunnion 14. A second annular sealing lip 45 on the resilient elastomeric member 44 also sealingly engages an acutely angle rim portion 48 of the annular metallic member 46. It should be noted that each of the annular sealing lips 52 and 45 is formed as an edge (see Fig. 2) since initial abutting contact of these lips is thereby "line contact"; this insures the absence of rounded corners and poor sealing.

The open end of the bearing race 16 is counterbored to provide an axially extending annular surface 59 and a laterally or radially extending shoulder 60. The annular metallic member 42 of L-shaped cross-section is pressed into the bearing race, an axially extending rim portion 43 of the annular metallic member 42 being in a press fit relationship with the surface 59, until a laterally extending rib portion 62 of the annular metallic member 42 abuttingly engages the surface 60. The surface 60 locates the annular metallic member 42 in its proper axially inward position from the radial outer face 20 of the trunnion 14. The annular metallic member 42, in turn, positions the needle bearings 30 in the axial direction by engaging them when in this position.

In the assembled relationship of the sealing means as shown in Fig. 2, the first annular sealing lip 52 is biased, by the sealing surface 50, axially outward in a direction parallel to the axis of the trunnion 14. As the universal joint 10 increases in speed the centrifugal force on the lip tends to throw it axially further outward, whereby it seeks or is pressed into a tighter sealing relationship with sealing diameter 50. In this biased position, the lip 52 deforms in a radially inward direction so that a radially outwardly sloping face 53 of it more fully engages the sealing surface 50 thereby providing the aforementioned tighter sealing relationship. During lubrication, however, or when an excess of lubricant is in the universal joint 10 the pressurized lubricant is capable of forcing the annular lip 52 axially inwardly and radially outwardly so that a clearance is provided between it and surface 50 for the escape of lubricant.

In the same manner, the second annular sealing lip 45 is biased by an acute angled surface 47 formed on acutely angled rim portion 48 of the annular metallic member 46 such that escaping lubricant can be forced

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between the lip 45 and the angled surface 47 of the annular metallic member 46. Any limited amounts of contaminants, such as dirt or mud, reaching and impinging against the lip 45 cause the lip to seal more tightly against the acutely angled surface 47 thereby preventing these contaminants from reaching the annular sealing lip 52.

Impingement of contaminants against the lip 45 is severely limited by the following arrangement. The radially extending rim portion 43 of the annular metallic member 42 is nested within the annular metallic member 46 in a manner to form a circumferentially extending gap 49 between the radially inward extending leg 43 of the L-shaped member 42 and the radially outward extending leg 41 of the U-shaped member 46. This gap and the tortuous path between it and the elastomeric member 44 thereby acts as a labyrinth type seal between the respective metallic members to help prevent contaminants from reaching the resilient elastomeric member 44 of the seal. The annular metallic member 46 additionally covers and protects the elastomeric member 44 so that the major portion of atmospheric contaminants are unable to directly come into contact with this element to cause deterioration of it and thereby shortened joint life.

As was mentioned previously, the annular metallic member 42 and the elastomeric member 44 are bonded together in a unitary assembly. The effect of this bonding may be advantageously increased by providing a series of projecting knobs 43A on the elastomeric member 44 which extend into a series of corresponding holes 43B formed in the metallic member 42. The interlocking fit provided thereby is extremely secure and may be utilized in the event that operational problems are engendered by utilizing only a normal bond between these two parts.

WHAT WE CLAIM IS:—

1. A seal for sealing the space between a bearing race member and a trunnion, comprising a first annular metallic member encircling the trunnion, an annular elastomeric member which encircles the trunnion between the trunnion surface and the first annular metallic member and is bonded to the first annular metallic member, and a second annular metallic member, of generally U-shaped radial cross-section, encircling the trunnion spacedly from the first annular metallic member, the second annular metallic member partially encompassing the annular elastomeric member and the first annular metallic member to form a labyrinth seal therebetween.

2. A seal as claimed in Claim 1, wherein the second annular metallic member is disposed with a portion thereof abutting said trunnion.

3. A seal as claimed in Claim 1 or 2, wherein the second annular metallic member sealingly abuts a portion of the elastomeric member.

4. A seal as claimed in any one of the preceding claims, wherein bearings are disposed in the bearing race and the first annular metallic member provides positive spacing for the said bearings.

5. A seal as claimed in any one of the preceding claims, wherein the elastomeric member is bonded to the radially inner surface of the first annular metallic member.

6. A seal as claimed in any one of the preceding claims, wherein the first annular metallic member is formed with two inclined annular rim portions so as to be of generally L-shaped radial cross-section and wherein the elastomeric member is disposed generally at the apex of the annular recess defined by the said two annular rim portions.

7. A seal as claimed in Claim 6, wherein one of the said two annular rim portions of the first annular metallic member is disposed substantially parallel to the axis of the trunnion.

8. A seal as claimed in any one of the preceding claims, wherein the elastomeric member is provided with a pair of annular sealing lips, one of the annular sealing lips sealingly abutting the second annular metallic member and the other of the annular sealingly abutting the trunnion.

9. A seal as claimed in Claim 8, wherein the said one of the annular sealing lips extends axially inwardly from the elastomeric member and the said other one of the annular sealing lips extends radially inwardly into contact with the trunnion.

10. A seal as claimed in Claim 9 when Claim 8 is read as appendant to Claim 7, wherein the second annular metallic member encircles the trunnion at its axially inner extremity with the open end of the second annular metallic member being disposed in a direction towards the axially outer portion of the trunnion, the second annular metallic member receiving the said one of the annular sealing lips of the elastomeric member and the said one of the said two annular rim portions of the first annular metallic member in its opening, thereby to form a labyrinthine structural relationship for the seal.

11. A seal as claimed in any one of Claims 8, 9 and 10, wherein a face extending from the said other of the annular sealing lips of the elastomeric member slopes radially outwardly from the periphery of the trunnion.

12. A seal as claimed in any one of the preceding claims, wherein the first annular metallic member is formed with a plurality of holes therein.

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13. A seal for sealing the space between a bearing race member and a trunnion, substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawing.

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1210191 COMPLETE SPECIFICATION
1 SHEET
This drawing is a reproduction of the Original on a reduced scale

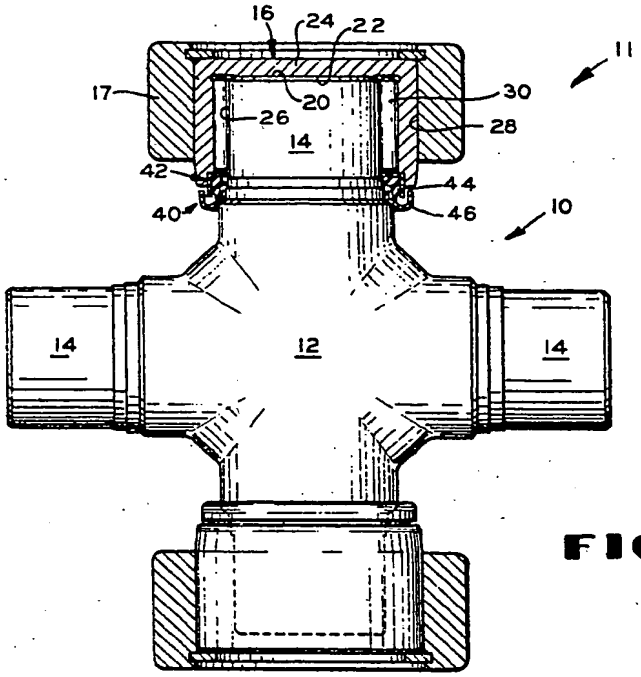

FIG. 1

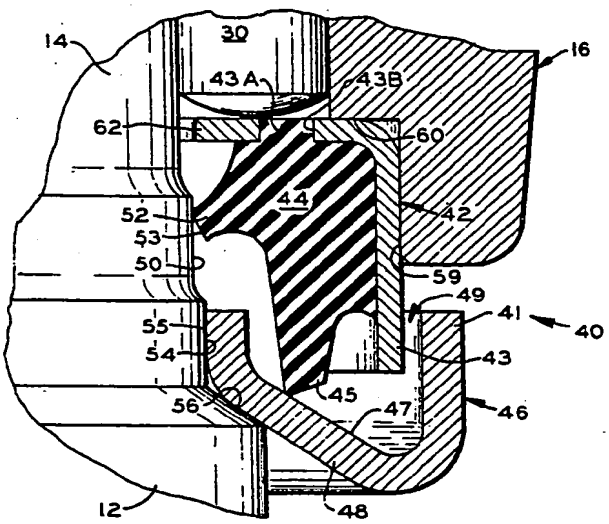

FIG. 2

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